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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,461	08/18/2003	Qi Xiang	0180144	4140

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EXAMINER	
NGUYEN, JOSEPH H	

ART UNIT	PAPER NUMBER
2815	

MAIL DATE	DELIVERY MODE
06/05/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/643,461	XIANG ET AL.	
	Examiner	Art Unit	
	JOSEPH NGUYEN	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,6,9,10,13,15,19 and 21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,6,9,10,13,15,19 and 21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1 and 3 are rejected under 35 U.S.C. 102(e) as being anticipated by Solomon et al. (U.S. Patent No. 6,803,266).

Regarding claim 1, Solomon et al. discloses in figure 1 a FET situated over a substrate (10), said FET comprising a channel (20) situated in said substrate; a first gate dielectric (16) situated over said channel, said first gate dielectric having a first coefficient of thermal expansion; a first gate electrode (18) situated over said first gate dielectric, said first gate electrode having a second coefficient of thermal expansion; wherein said first gate electrode and said first gate dielectric are selected such that said second coefficient of thermal expansion is greater than said first coefficient of thermal expansion so as to cause an increase in carrier mobility in said FET channel.

It is noted that the first gate dielectric (16) is made of silicon dioxide and the first gate electrode (18) made of tungsten (col. 3, lines 57-60 and col. 4, lines 12-15). The coefficients of thermal expansion of silicon dioxide and tungsten are $2.3X10^{-6}$ /K

(paragraph [0084] of U.S. Publication No. 2008/0278787, provided herein as evidence only) and $4.5X10^{-6}$ /K (paragraph [0043], U.S. Publication No. 2009/0099553, provided herein as evidence only) respectively. Therefore, the second coefficient of thermal expansion is greater than the first coefficient of thermal expansion so as to cause an increase in carrier mobility in said FET channel since the difference in the first coefficient of thermal expansion and the second coefficient of thermal expansion inherently causes an increase in carrier mobility in said FET.

Regarding claim 3, Solomon et al. discloses in figure 1 said increase in said carrier mobility is caused by a tensile a tensile strain created in said channel 20.

Regarding claim 15, Solomon et al. discloses in figure 1 a FET situated over a substrate (10), said FET comprising a channel (20) situated in said substrate; a gate stack situated over the channel; a first gate dielectric (16) situated in said gate stack, said first gate dielectric having a first coefficient of thermal expansion; a first gate electrode (18) situated over said first gate dielectric, said first gate electrode having a second coefficient of thermal expansion; wherein said first gate electrode and said first gate dielectric are selected such that said first coefficient of thermal expansion is greater than said second coefficient of thermal expansion so as to cause an increase in carrier mobility in said FET channel, and wherein said FET is a pFET (CMOSFET comprises nFET and pFET).

It is noted that Solomon teaches in col. 3, lines 59-63 the first gate dielectric (16) may be made of Al_2O_3 (sapphire) and the first gate electrode (18) made of tungsten (col. 4, lines 12-15). The coefficients of thermal expansion of sapphire and tungsten are

$7.5X10^{-6}$ /K (paragraph [0018] of U.S. Publication No. 2008/0296609, provided herein as evidence only) and $4.5X10^{-6}$ /K (paragraph [0043], U.S. Publication No. 2009/0099553, provided herein as evidence only) respectively. Therefore, the first coefficient of thermal expansion is greater than the second coefficient of thermal expansion so as to cause an increase in carrier mobility in said FET channel since the difference in the first coefficient of thermal expansion and the second coefficient of thermal expansion inherently causes an increase in carrier mobility in said channel.

Regarding claim 19, Solomon et al. discloses the first coefficient of thermal expansion is greater than the second coefficient of thermal expansion, and thus it is inherent the difference in the first coefficient of thermal expansion and the second coefficient of thermal expansion inherently causes said increase in carrier mobility by causing a compressive strain in said channel.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 6, 9, 10, 13 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Solomon et al.

Regarding claims 6, 9, 10, 13 and 21, Solomon et al. disclose in figure 1 substantially all the structure set forth in the claimed invention. See rejection of claims 1,

3, 15 and 19 above. Solomon et al. further discloses in col. 4, lines 13-20 the gate dielectric (16) is preferably ultra thin, which as used herein refers to thicknesses of about 5nm (50A) or less. In other words, Solomon et al. does not exclusively disclose the gate dielectric has a thickness of between 10A and 15A. However, In re Aller, 220, F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) the Court held that where the general conditions of a claim are discussed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." Therefore, it would have been obvious at the time of the present invention to modify Solomon et al. by including the gate dielectric having a thickness of between 10A and 15A, since this only involves routine skill in the art.

Response to Arguments

3. Applicant's arguments with respect to claims 1, 3, 6, 9, 10, 13, 15, 19 and 21 have been considered but are moot in view of the new ground(s) of rejection.

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Nguyen whose telephone number is (571) 272-1734. The examiner can normally be reached on Monday-Friday, 7:30 am- 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/J. N./

Examiner, Art Unit 2815

/Kenneth A Parker/

Supervisory Patent Examiner, Art Unit 2815